EPA Region 7 TMDL Review

TMDL ID: KS-LA-13-346_12 **Waterbody ID(s):** KS-LA-13-346_11, KS-LA-13-346_13, KS-LA-13-346_14, KS-LA-13-346_15, KS-LA-13-346_16

Waterbody Name(s): Cowskin Creek

Tributary(ies): Big Slough(11), Dry Creek(15), Dry Creek(16)

Pollutant(s): Nutrients and Oxygen Demand Impact on Aquatic Life & pH

State: Kansas **HUC(s):** 11030013

Basin: Lower Arkansas River Basin

Submittal Date: January 9, 2007

Approved: Yes

Submittal Letter

State submittal letter indicates final Total Maximum Daily Load(s) (TMDL) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act.

Letter for Cowskin Creek Phase I was received by EPA on July 20, 2000, formally submitting this TMDL for approval.

Letter dated December 27, 2007, was received by EPA January 9, 2007, formally submitting this Phase II TMDL for approval. KDHE sent a revised copy of the Cowskin Creek TMDL, due to EPA comments, on March 22, 2007.

KDHE sent a revised copy of the Cowskin Creek TMDL, due to EPA comments, on July 20, 2007.

Water Quality Standards Attainment

The water body's loading capacity (LC) for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards (WQS) [40 CFR § 130.7©(1)].

On this stream segment, the average KBI is partially supporting (KBI>2.6) and MBI indicates that aquatic life support is partially impaired (MBI between 4.51 and 5.39). Seven of thirteen surveys resulted in MBI values over 4.5, and the other half were under 4.5. One KBI score was nonsupporting, three were fully supporting, and the remaining nine were partially supporting. Five of thirteen surveys had fully supporting EPT percentages (>48%), however only two surveys met the full support criteria (>12) for number taxa present. The collective results indicate that the biotic community at SB346 is impaired, and that Cowskin Creek continues to exceed viable conditions for full support of aquatic life use support.

The load capacity for nitrogen, phosphorus and TSS is determined as the product of the new flow and the desired concentrations of 2.0 mg/l, 0.2 mg/l and 100 mg/l, respectively. Wastewater comprises all the flow at the 90th and 75th percentiles, therefore, Wasteload Allocations make up the total load capacities at those flows. Because wastewater is treated to produce low TSS (~30 mg/l), the load capacity and Wasteload Allocations at those two flow conditions were based on a concentration of 30 mg/l. When this reduction is accomplished, water quality standards should be achieved.

Numeric Target(s)

Submittal describes applicable WQS, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

In Phase 1, the State (and EPA) had not determined the appropriate numeric criteria for nutrients. The numeric target used as a surrogate indicator is an average MBI value of 4.5 or less. The first phase of this TMDL targets initial reduction in the critical parameters which are believed to be sufficient to reestablished biological integrity to the reach. Further monitoring and evaluation will be performed.

The use of biological indices allows assessment of the cumulative impacts of dynamic water quality on aquatic communities present within the stream. As such, these index values serve as a baseline of biological health of the stream. Sampling occurs during open water season (April to November) within the aquatic stage of the life cycle of the macroinvertebrates. As such there is no described seasonal variation of the desired endpoint of this TMDL. The endpoint would be average MBI value of 4.5 or less over 2006-2013.

Nutrients-Narrative standard (KAR 28-16-28e(c)(2)(B)). Biological endpoints, the Macroinvertebrate Biotic Index (MBI) and Ephemeroptera, Plecoptera and Trichoptera Index (EPT) were used to evaluate this narrative standard. Critical parameters which contribute to the MBI and EPT include Total Phosphorus, Nitrate, Ammonia, BOD, and TSS. Phase One of this TMDL used best professional judgment to establish target TMDL values for each of these parameters. Decreased nutrient loads should result in aquatic communities indicative of improved water quality and supporting the Expected Aquatic Life Use designation. Phase two monitoring will confirm the selection of these parameters. pH range is 6.5-8.5 for Aquatic Life Support Use (KAR 28-16-28e(d)).

Achievement of an average MBI of 4.5 or less of this endpoint would be indicative of full support of the aquatic life use in the stream reach. While the narrative water quality standard pertaining to nutrients is utilized by this TMDL, there is no direct linkage between MBI values and nutrient levels, a number of factors may contribute to the occasional excursion in index values above 4.5. These include flow conditions, adequate habitat and stream modifications. The link between MBI values and nutrient levels on Cowskin Creek remains qualitative at this stage of the TMDL.

The applicable designated uses include expected aquatic life support, primary contact recreation, domestic water supply, food procurement, ground water recharge, and livestock watering use for main stem segments.

Cowskin Creek's impaired use is expected aquatic life support on main stem segments.

The pH endpoint for this system will be water with less than the upper pH criteria (8.5). pH range of 6.5-8.5 for aquatic Life Support (KAR 28-16-28 e (d)).

Numeric Targets(s) and Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety (MOS) that do not exceed the LC.

There is a direct relationship between heightened nutrient levels and sediment concentrations. Therefore, the primary allocation of loads for non-point sources will concentrate on reduction of sediment levels in the stream. Current TSS concentrations during runoff conditions exceed 100mg/l and total phosphorus levels are over 400ppb.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, nonpoint and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

Phase I source analysis describes all NPDES wasterwater dischargers, livestock waste management systems, land use, on-site waste systems, contributing runoff (given soil types) and background levels of potential sources of pollutants in the watershed. Maps portraying land use, NPDES sites, and livestock management sites are also provided.

Phase II has an updated summary of NPDES discharges to Cowskin Creek. Cowskin Creek TMDL also covers stormwater NPDES permits, livestock waste management systems, land use, on-site waste systems, contributing runoff and background levels of potential sources of pollutants in the watershed.

Facility	NPDES #	KS Permit #	Type	Receiving Stream	Design Flow (MGD)	2005 Flow (MGD)	2005-6 BOD	2005-6 TSS
Wichita #3	KS0095681	M-AR94-OO03	Activated Sludge	Cowskin Creek	2.0	0.5	3 mg/l	2 mg/l
Abengoa Bioenergy	KS0081329	I-AR24-PO02	Aerated Lagoon	Cowskin Creek via Trib	0.035	0.16	44 mg/l	33 mg/l
Colwich	KS0090956	M-AR24-OO02	3-Cell Lagoon	Cowskin Creek	0.187	N/A	21 mg/l	46 mg/l
Andale	KS0092223	M-AR03-OO01	4-Cell Lagoon	Cowskin Creek via Trib	0.13	N/A	7 mg/l	6 mg/l
Goddard	KS0024791	M-AR37-OO01	4-Cell Lagoon	Cowskin Creek via Dry Creek	0.38	N/A	24	58
Proposed Wichita #4	N/A	N/A	Activated Sludge	Cowskin Creek	3.0	N/A	N/A	N/A
Westar – Gordon Evans	KS0000604	I-AR24-PO01	Cooling Water Blowdown w/ Ponds	Upper Cowskin Creek	2.031	2.19	N/A	N/A
Westar – Murray Gill	KS0000621	I-AR94-PO13	Cooling Water Blowdown w/ Ponds	Upper Cowskin Creek	2.50	1.75	N/A	N/A

(Table 6- Summary of dischargers to Cowskin Creek.)

Both the City of Wichita and Sedwick County have Stormwater NPDES permits and urban stormwater programs. As part of their permits, the urban areas are to put in place at least one Best Management Practice to address the pollutants for any TMDLs that may fall within their jurisdiction. The Sedgwick County permit is tied to TMDLs for Cowskin Creek. Wichita has a Phase One permit and has established its stormwater management program that continues to evolve toward addressing issues along Cowskin Creek.

Twenty-five operations are permitted within the watershed upstream of SB346, accounting for a potential of up to 5,843 animal units. A majority of those operations are dairy (10). There are eight cattle, one sheep, four swine, and one sheep, four swine, and one swine/chickens LM operations in the Cowskin Creek watershed. All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating from their areas. Such systems are designed for the 25 year, 24 hour rainfall/runoff event, which would be indicative of flow durations well under 10 percent of the time. The actual number of animal units on site is variable but typically less than permitted numbers.

It seems all significant sources have been identified.

Allocation

Submittal identifies appropriate WLA for point, and load allocations for nonpoint sources. If no point sources are present the WLA is stated as zero. If no nonpoint sources are present, the LA is stated as zero [40 CFR § 130.2(i)]. If this is a phase II TMDL the change in LC will be documented in this section.

The loading capacity established for Phase I was based on restoring biological integrity based on an MBI of 4.5 or less. An individual loading capacity is established for those parameters believed to be affecting the MBI.

percentile	est flow	flow - ww	new ww	future flow	TN LC	TN WLA	TN MS4	TN LA	TP LC	TP WLA	TP MS4	TP LA	TSS LC	TSS WLA	TSS MS4	TSS LA
90	2.65	0	17.29	17.29	186.7	186.7	0.0	0.0	18.7	18.7	0.0	0.0	1.4	1.4	0.0	0.0
75	6.86	0	17.29	17.29	186.7	186.7	0.0	0.0	18.7	18.7	0.0	0.0	1.4	1.4	0.0	0.0
50	16	9.14	17.29	26.43	285.4	186.7	46.4	52.3	28.5	18.7	4.6	5.2	7.1	1.4	2.7	3.0
25	35.3	28.44	17.29	45.73	493.9	186.7	144.4	162.8	49.4	18.7	14.4	16.3	12.3	1.4	5.1	5.8
10	82	75.14	17.29	92.43	998.2	186.7	381.4	430.1	99.8	18.7	38.1	43.0	25.0	1.4	11.1	12.5

(Table 11- Load Capacities, Wasteload Allocations and Load Allocations for Nitrogen, Phosphorus and TSS at Monitoring Site 288.)

Point Sources: This revised TMDL will establish wasteload allocations based upon technology performance to remove nutrients from the various treatment types used by dischargers in the watershed. Previous studies have indicated that average TP and TN values from well-operated lagoon systems are 2 mg/l and 7 mg/l, respectively. The Kansas Nutrient Plan anticipates that typical biological nutrient removal at mechanical plants can achieve 1.5 mg/1 TP and 8 mg/l TN, as annual averages.

Non Point Sources: There is a direct relationship between heightened nutrient levels and sediment concentrations. Therefore, the primary allocation of loads for non-point sources will concentrate on reduction of sediment levels in the stream.

WLA Comment

Submittal lists individual WLAs for each identified point source [40 CFR § 130.2(h)]. If a WLA is not assigned it must be shown that the discharge does not cause or contribute to WQS excursions, the source is contained in a general permit addressed by the TMDL, or extenuating circumstances exist which prevent assignment of individual WLAs. Any such exceptions must be explained to a satisfactory degree. If a WLA of zero is assigned to any facility it must be stated as such [40 CFR § 130.2(i)]. If this is a phase II TMDL any differences in phase I and phase II WLAs will be documented in this section.

Phase I the WLA is defined as loads between 65% and 100% on the load duration curves for each of the parameters. 65% was selected based on current and projected point source design flows needed by the municipalities and is set at 5.1 cfs.

This revised TMDL will establish wasteload allocations based upon technology performances to remove nutrients from the various treatment types used by dischargers in the watershed. Previous studies have indicted that average TP and TN values from well-operated lagoon systems are 2 mg/l and 7 mg/l, respectively. The Kansas Nutrient Plan anticipates that typical biological nutrient removal at mechanical plants can achieve 1.5 mg/1 TP and 8 mg/l TN, as annual averages.

Facility	Design Flow (MGD)	Effluent TP Conc. ppm	TP WLA lbs./day	Effluent TSS mg/l	Effluent TSS lbs./day	Effluent TN Conc. ppm	TN WLA lbs./day
Wichita #3	2.0	1.5	25.1	30	500	8.0	133.7
Abengoa Bioenergy*	0.16	2.0	2.7	80	106	7.0	9.4
Colwich	0.187	2.0	3.1	80	124	7.0	10.9
Andale	0.13	2.0	2.2	80	86	7.0	7.6
Goddard	0.8	1.5	10.0	80	200	8.0	53.6
Proposed Wichita #4	3.0	1.5	37.6	30	751	8.0	200.5
Gordon Evans	2.4	0.30	6.0	30	600	6.0	100
Murray Gill	2.5	0.50	10.4	30	625	6.0	125

(Table 10- Wasteload allocations for Cowskin Creek dischargers. *Abengoa is allocated for a projected design flow corresponding to their current average discharge.)

CAFOs do not discharge to Cowskin Creek and have a WLA of 0 lbs/day. Wasteload allocations for the Westar facilities were based on maximum projected wastewater flows and maximum phosphorus and nitrogen concentrations seen over 2003-2005, which were still significantly less than most other dischargers to Cowskin Creek. Annual average concentrations and loads are expected to be much less than those presented by this TMDL.

Facilities will continue to maintain pH of less than 8.5 in their effluent.

Wasteload allocations for the Westar facilities were based on maximum projected wastewater flows and maximum phosphorus and nitrogen seen over 2003-2005, which were still significantly less than most other dischargers to Cowskin Creek. Annual average concentrations and loads are expected to be much less than those presented by this TMDL.

The load capacity for nitrogen, phosphorus and TSS is determined as the product of the new flow and the desired concentrations of 2.0 mg/l, 0.2 mg/l and 100 mg/l, respectively. Wasterwater comprises all the flow at the 90th and 75th percentiles, therefore, Wasteload Allocations make up the total load capacities at those flows. Because wastewater is treated to produce low TSS (~30 mg/l), the load capacity and Wasteload Allocation at those two flow conditions were based on a concentration of 30 mg/l. Facilities will continue to maintain pH of less than 8.5 in their effluent.

Therefore, the Wasteload Allocation assigned to MS4 permits will be 47% of the permissible load over the Wasteload Allocations of the discharging NPDES facilities. This is determined by taking 47% of the difference between the load capacity and NPDES Wasteload Allocation for nitrogen, phosphorus and TSS.

LA Comment

Includes all nonpoint sources loads, natural background, and potential for future growth. If no nonpoint sources are identified the LA must be given as zero [40 CFR § 130.2(g)]. If this is a phase II TMDL any differences in phase I and phase II Las will be documented in this section.

With the application of Best Management Practices to curtail erosion, bank instability and sediment transport, the expected concentrations for nitrogen, phosphorus and TSS should remain below an average of 2.0 mg/l, 0.2 mg/l and 100 mg/l, repectively, under runoff conditions at Monitoring Site 288. The permissible load allocation for non-point sources will be 53% of the difference between load capacity and NPDES facility Wasteload Allocation. No load allocation is designated for low flows because those flows are dominated by wastewater.

percentile	est flow	flow - ww	new ww	future flow	TN LC	TN WLA	TN MS4	TN LA	TP LC	TP WLA	TP MS4	TP LA	TSS LC	TSS WLA	TSS MS4	TSS LA
90	2.65	0	17.29	17.29	186.7	186.7	0.0	0.0	18.7	18.7	0.0	0.0	1.4	1.4	0.0	0.0
75	6.86	0	17.29	17.29	186.7	186.7	0.0	0.0	18.7	18.7	0.0	0.0	1.4	1.4	0.0	0.0
50	16	9.14	17.29	26.43	285.4	186.7	46.4	52.3	28.5	18.7	4.6	5.2	7.1	1.4	2.7	3.0
25	35.3	28.44	17.29	45.73	493.9	186.7	144.4	162.8	49.4	18.7	14.4	16.3	12.3	1.4	5.1	5.8
10	82	75.14	17.29	92.43	998.2	186.7	381.4	430.1	99.8	18.7	38.1	43.0	25.0	1.4	11.1	12.5

(Table 11- Load Capacities, Wasteload Allocations and Load Allocations for Nitrogen, Phosphorus and TSS at Monitoring Site 288.)

Margin of Safety

Submittal describes explicit and/or implicit MOS for each pollutant [40 CFR § 130.7(c)(1)]. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided. If this is a phase II TMDL any differences in MOS will be documented in this section.

Phase I gave an explicit margin of safety of a proportion of EPT individuals making up a percent of the sample population, when MBI values are 4.5 or lower. This will ensure that the majority of aquatic macroinvertebrate population is composed of pollution intolerant taxa, thereby verifying the full support conditions for aquatic life indicated by the MBI value. Although not specifically stated in the MOS discussion, many conservative assumptions were also made; including target reductions in all of the parameters.

Given the variable nature of the MBI values seen on this stream, additional biological measures are necessary to assure indications of good aquatic community health. Therefore, the defined Margin of Safety for this TMDL will be a proportion of EPT individuals making up at least 55% of the sample population when MBI values are 4.5 or lower. The MOS will implicitly rely on pH values remaining below the aquatic life support standard of 8.5 indicating stream productivity lies within normal ranges. The pH margin of safety is implicit in the nutrient limits. Because pH exceedences are not the result of excessively alkaline wasterwater discharge, the margin of safety is defined by the significant reductions in nutrients which feed biological processes.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s) [40 CFR § 130.7©(1)]. Critical conditions are factors such as flow or temperature which may lead to the excursion of WQS. If this is a phase II TMDL any differences in conditions will be documented in this section.

Each load duration curves represent the entire seasonal flow regime expected at the site. Therefore, the TMDL accounts for every flow condition (seasonal variation and critical condition).

Public Participation

Submittal describes required public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s) [40 CFR § 130.7(c)(1)(ii)].

A public meeting was held in Hutchinson, KS on June 7, 2006. A hearing was held on September 13, 2006 in Hutchinson. The Basin Advisory committee met on June 7, 2006 in Hutchinson. Copies of comments and KDHE's responses were submitted with the package.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used) [40 CFR § 130.7].

KDHE will continue to collect seasonal biological samples from Cowskin Creek for at least three years over 2007-2011 and an additional three years over 2012-2016 to evaluate achievement of the desired endpoint. Monitoring of nutrient content of wastewater discharged from treatment systems will be expected under new and reissued NPDES and state permits, including ambient monitoring above and below the facilities.

Cowskin Creek has been monitored since 1985 at Station 288 and since 2001 at Station 730. Table 2 displays average values for certain parameters at both stations for various period of time. The years 2004-2006 coincide with the period when Wichita's Northwest Plant No. 3 began discharging to Cowskin Creek. The upstream station 790 has seen an average increase in total phosphorus since 2004, although the differences are not statistically significant.

Station	NH3	NO3	TP	PO4	Temp	DO	pH	TSS	Turb	BOD	TOC
288											
1985-2003	< 0.1	0.65	0.321	< 0.25	15.7	10.4	8.2	99	52	4.58	5.54
2001-2003	< 0.1	0.63	0.273	< 0.25	19.3	11.8	8.3	90	46	3.46	5.54
2004-2006	0.12	0.36	0.253	< 0.25	19.1	11.1	8.1	57	40	----	5.80
730											
2001-2003	< 0.1	0.35	0.386	< 0.25	17.5	9.7	8.0	95	74	4.82	7.4
2004-2006	0.15	0.34	0.425	0.27	17.1	8.8	7.8	62	45	----	8.17

(Table 2- Average values of selected parameters along Cowskin Creek.)

Table 4 indicates the average upstream and downstream values for nutrients, DO and solids from approximately 40 samples taken over 2003-2006. There is no apparent impact from the wastewater plant, except some increase in total phosphorus and TKN.

Location	NH3	NO2	NO3	TKN	TP	TSS	DO	# of Samples with DO < 5
Upstream	0.28	0.07	1.10	2.14	0.45	85	6.9	13
Downstream	0.23	0.06	0.99	2.26	0.53	73	7.4	10

(Table 4- Average concentrations above and below the outfall of Wichita Plant #3.)

Reasonable assurance

Reasonable assurance only applies when less stringent WLAs are assigned based on the assumption of nonpoint source reductions in the LA will be met [40 CFR § 130.2(i)]. This section can also contain statements made by the state concerning the state's authority to control pollutant loads.

Reasonable assurances are not required as there are no point sources involved in the impairment targeted by this TMDL. The State of Kansas has authorities to direct activities in the watershed to reduce pollution. These include water and basin plans and the Federal Insecticide, Fungicide and Rodenticide Act.

Phase II TMDL

TMDL was identified as a Phase II